



Journal of Food Quality and Hazards Control 4 (2017) 29-31

# Heavy Metals Residue in Cultivated Mango Samples from Iran

M. Rahimzadeh <sup>1</sup>, S. Rastegar <sup>2\*</sup>⊠

- 1. Food Health Research Center, Faculty of Medicine, Hormozgan University of Medical Sciences, Bandar Abbas, Iran
- 2. Department of Horticultural Science, College of Agriculture, University of Hormozgan, Bandar Abbas, Iran

## **HIGHLIGHTS**

- Heavy metal levels were significantly higher in green mango samples comparing to ripe ones.
- No significant relationship was seen between heavy metals residue and variety in genotypes of mangos.
- Low heavy metal levels found in this study showed acceptable safety of Iranian mango samples.

## Article type

Short communication

## Keywords

Mangifera Metals, Heavy Iran

### Article history

Received: 31 Oct 2016 Revised: 21 Dec 2016 Accepted: 13 Jan 2017

## Acronyms and abbreviations

Pb=Lead Cr=Chromium Cd=Cadmium As=Arsenic

#### **ABSTRACT**

**Background:** Heavy metals contaminations are recognized as the serious risk to our environment. The aim of the present study was to analyze heavy metals residue in cultivated mango samples from Iran.

**Methods:** Totally, 72 mango samples were randomly collected among six different mango genotypes cultivated in Southern Iran from June to July 2015. Lead, chromium, cadmium, and arsenic were determined using an atomic absorption spectrometer. Analysis of variance was performed with SAS 9.0. Descriptive statistics, multivariate analysis, and Duncan multiple range tests were done with a significance level of p < 0.05.

**Results:** Measurement of heavy metals in all the mango samples showed various level ranges of lead (0.008-0.05 ppm), chromium (0.01-0.1 ppm), cadmium (0.002-0.014 ppm), and arsenic (0.01-0.04 ppm). Heavy metal levels were significantly (p<0.05) higher in green mango samples comparing to ripe ones. However, no significant relationship (p>0.05) was seen between heavy metals residue and variety in genotypes of mango samples.

**Conclusion:** The average amount of heavy metals residue in mango samples found in the current study were generally below the maximum acceptable levels indicating acceptable safety of these products.

## Introduction

Fruits are suitable sources of vitamin C, carotenoids, minerals, various kinds of antioxidants, and dietary fiber; then a diet rich in fruits is defensive against degenerative and chronic diseases such as cancer and cardiovascular diseases (Wang et al., 1996).

Contamination of fruits with heavy metals can cause serious health problems and so the amount of heavy metal contamination of foods is considered as the food quality insurance. However, in the last years, the increasing request of food safety has encouraged researches about the risk related to eating of foods contaminated by

toxic compounds (Zaidi et al., 2005). Heavy metal contamination in edible plants may be related to soil nature, climate change, irrigation with contaminated water, addition of fertilizers, etc. (Sanayei et al., 2009; Voutsa et al., 1996; Yusuf et al., 2003). Heavy metals are harmful compounds even at low concentration which have non-biodegradable nature and long half-lives. Since body does not have enough mechanisms for heavy metal elimination, therefore serious damages to human and animal tissues may happen upon contamination (Sardar et al., 2013). Accumulation of heavy metals in body may

To cite: Rahimzadeh M., Rastegar S. (2017). Heavy metals residue in cultivated mango samples from Iran. *Journal of Food Quality and Hazards Control*. 4: 29-31.

<sup>\*</sup>Corresponding author. <sup>™</sup> rastegarhort@gmail.com

cause to disrupt function in vital organs such as heart, brain, kidneys, prostrate, ovary, bone, and liver; on the other hand, they displace the vital nutritional minerals from their original place (Singh et al., 2011).

In Southern Iran, mango (Mangifera indica L.) is generally used in different stages of fruit development; from the tiny imperfectly set fruits to the fully ripened stage. Green fruit (immature or tender) is eatable in summer which is usually consumed in dessert from Iran. The immature green fruits are also chopped up for mango pickle and used instead of tamarind in various dishes where an acid flavor is desired. Ripened fruit is red or yellow in color and is consumed as fresh fruit. Usually ripened fruit has short shelf life and losses its quality during one week. It has been stated that variety and developmental stages of mango fruit can affect on chemical characters during fruit growth (Tharanathan et al., 2006).

Previous studies in some countries showed that depending on production site, heavy metal contamination in fruits should be monitored from view point of public health (Elbagermi et al., 2012; Grembecka and Szefer, 2013; Ismail et al., 2011). To the best of the author's knowledge, no comparative analysis of heavy metals has been carried out on native mango fruit in Iran. Therefore, the aim of the present study was to analyze some heavy metals residue including, Lead (Pb), Chromium (Cr), Cadmium (Cd), and Arsenic (As) in cultivated mango samples from Iran.

### Materials and methods

Totally, 72 mango samples were randomly collected among six different mango genotypes including, Sibi, Sarshahi, Sabzanbeh, Kalaksorkh, Mahali-14, as well as Mahali-17 cultivated in commercials gardens in three

locations of Minab (Hormozgan province of Iran) from June to July 2015. Fruit samples were washed, cut, and stored to obtain two different green and ripening stages for next analysis step.

The samples were first oven dried at 70  $^{\circ}$ C for 24 h; then 0.5 g of each dried sample was heated at 550  $^{\circ}$ C in a muffle furnace for 4-5 h. The resultant ash was dissolved in 5 ml Analar Grade hydrochloric acid (20%), as well as distilled water was added up to 50 ml. Pb, Cr, Cd, and also As were determined using an atomic absorption spectrometer (GBC, SavantAA  $\Sigma$ , Australia) according to AOAC (1990).

All analyses were conducted in triplicate and results were expressed as means $\pm$ standard deviation. Analysis of variance was performed with SAS 9.0. Descriptive statistics, multivariate analysis, and Duncan multiple range tests were done with a significance level of p<0.05.

### **Results and discussion**

Measurement of heavy metals in all the mango samples showed various level ranges of Pb (0.008-0.05 ppm), Cr (0.01-0.1 ppm), Cd (0.002-0.014 ppm), and As (0.01-0.04 ppm). Heavy metal levels were significantly (p<0.05) higher in green mango samples comparing to ripe ones (Table 1). However, no significant relationship (p>0.05) was seen between heavy metal residues and variety in genotypes of mango samples. Decreasing heavy metals concentration with ripening could be due to the fact that mineral absorption is high during early developmental stages. It could also be attributed to dilution effect as increasing fruit cell and enhancing considerable weight (due to gaining water) during the ripening (El Buluk et al., 1996).

Table 1: Heavy metals concentration in different mango samples

Mango type		Sample	Heavy metals concentration (ppm)			
		number	Lead	Chromium	Cadmium	Arsenic
Sibi	Green	6	0.05±0.002	0.1±0.002	0.016±0.001	0.04±0.002
	Ripe	6	$0.009\pm0.001$	$0.07\pm0.003$	$0.004\pm0.001$	$0.02\pm0.001$
Sarshahi	Green	6	0.04±0.002	0.09±0.003	0.01±0.002	0.03±0.002
	Ripe	6	$0.009\pm0.002$	$0.03\pm0.002$	$0.002\pm0.001$	$0.01\pm0.004$
Sabzanbeh	Green	6	0.03±0.003	0.08±0.002	0.01±0.002	0.03±0.001
	Ripe	6	$0.008\pm0.001$	$0.02\pm0.001$	$0.006\pm0.001$	$0.01\pm0.003$
Kalaksorkh	Green	6	0.03±0.002	0.1±0.004	0.01±0.002	0.04±0.002
	Ripe	6	$0.009\pm0.002$	$0.04\pm0.002$	$0.004\pm0.002$	$0.01\pm0.002$
Mahali-14	Green	6	0.04±0.003	0.09±0.003	0.014±0.004	$0.04\pm0.003$
	Ripe	6	$0.01\pm0.004$	$0.01\pm0.001$	$0.005\pm0.001$	$0.02\pm0.001$
Mahali-17	Green	6	0.04±0.002	0.08±0.004	0.008±0.001	0.03±0.003
	Ripe	6	0.009±0.001	0.01±0.002	$0.006\pm0.002$	$0.01\pm0.002$

There are some studies conducted in the other parts of the world to assess the heavy metal contamination of fruits and vegetables. Sajib et al. (2014) studied heavy metals content of ten tropical fruits in Bangladesh and reported 0.02 mg/kg level of Pb in mango fruit. Shaheen et al. (2016) reported that As, Pb, Cr, and Cd in mango

fruit from Bangladesh were 0.013, 0.6, 0.8, as well as 0.005 ppm, respectively. Saha et al. (2012) reported that the concentration range of Cr in vegetable and fruit from Bangladesh was found between 0.17 to 1.93 and 0.5 to 2.5 mg/kg, respectively. Also, Akhtar et al. (2010) showed that Cd contents of mango samples in Pakistan were in the ranges of 0.17–0.22 ppm. In another research, Elbagermi et al. (2012) showed that the mean levels of Pb and Cd in mango samples of Misurata area of Libya were 1.824 and 0.362 ppm, respectively which are higher than our findings. This deference may be due to the diversity in environmental condition, irrigation water, soil pollution, fertilizer, and application of pesticide in different agricultural regions.

Among different interested heavy metals in this study, Cr showed the highest level in all mango genotypes followed by Pb, As, and Cd, respectively. Mausi et al. (2014) evaluated some selected heavy metals (Pb, Cr, and Cd) in mangoes in Kenya. They showed that heavy metal occurrence in mango fruit had the following order: Cr>Pb>Cd which is similar to the results of present study.

#### Conclusion

The average amount of heavy metal residues in mango samples found in the current study were generally below the maximum acceptable levels indicating acceptable safety of these products. To the best of the author's knowledge, this is the first comparative analysis about assessment of heavy metals in both green and ripe native mango samples of Southern Iran.

# **Conflicts of interest**

The authors declare that they have not any conflict of interest.

# Acknowledgements

This study as research project (code number: 9462) was financially supported by Food Health Research Center, Hormozgan University of Medical Sciences, Bandar Abbas, Iran. This research was ethically approved by the local institutional review board.

#### References

- Akhtar S., Riaz M., Ahmad A., Nisar A. (2010). Physico-chemical, microbiological and sensory stability of chemically preserved mango pulp. *Palestinian Journal of Botany*. 42: 853-862.
- Association of Official Analytical Chemists (AOAC). (1990). Official methods of analysis (15<sup>th</sup> ed.). AOAC, Inc, USA.
- El Buluk R.E., Babiker F.E., El Tinay A.H. (1996). Changes in sugar, ash and minerals in four guava cultivars during ripening. Plant Foods for Human Nutrition. 49: 147-154.
- Elbagermi M.A., Edwards H.G.M., Alajtal A.I. (2012). Monitoring of heavy metal content in fruits and vegetables collected from production and market sites in the Misurata area of Libya. *ISRN Analytical Chemistry*. doi:10.5402/2012/827645.
- Grembecka M., Szefer P. (2013). Comparative assessment of essential and heavy metals in fruits from different geographical origins. Environmental Monitoring and Assessment. 185: 9139-9160.
- Ismail F., Anjum M.R., Mamon A.N., Kazi T.G. (2011). Trace metal contents of vegetables and fruits of Hyderabad retail market. Pakistan Journal of Nutrition. 10: 365-372.
- Mausi G., Simiyu G., Lutta S. (2014). Assessment of selected heavy metal concentrations in selected fresh fruits in Eldoret Town, Kenya. *Journal of Environment and Earth Science*. 4: 1-8.
- Saha N., Zaman M.R., Rahman M.S. (2012). Heavy metals in fish, fruits and vegetables from Rajshahi, Bangladesh: a statistical approach. *Journal of Nature Science and Sustainable Technology*. 6: 237-252.
- Sajib M.A.M., Hoque M.M., Yeasmin S., Khatun M.H.A. (2014). Minerals and heavy metals concentration in selected tropical fruits of Bangladesh. *International Food Research Journal*. 21: 1731-1736
- Sanayei Y., Ismail N., Talebi S.M. (2009). Determination of heavy metals in Zayandeh rood river, Isfahan-Iran. World Applied Science Journal. 6: 1209-1214.
- Sardar K., Ali S., Hameed S., Afzal S., Fatima S., Shakoor M.B., Bharwana S.A., Tauqeer H.M. (2013). Heavy metals contamination and what are the impacts on living organisms. Greener Journal of Environmental Management and Public Safety. 2: 172-179.
- Shaheen N., Irfan N.M., Khan I.N., Islam S., Islam M.S., Ahmed M.K. (2016). Presence of heavy metals in fruits and vegetables: health risk implications in Bangladesh. *Chemosphere*. 152: 431-438.
- Singh R., Gautam N., Mishra A., Gupta R. (2011). Heavy metals and living systems: an overview. *Indian Journal of Pharmacology*. 43: 246-254.
- Tharanathan R.N., Yashoda H.M., Prabha T.N. (2006). Mango (Mangifera indica L.), the king of fruits. Food Reviews International. 22: 95-123.
- Voutsa D., Grimanis A., Samara C. (1996). Trace elements in vegetables grown in an industrial area in relation to soil and air particulate matter. *Environmental Pollution*. 94: 325-335.
- Wang H., Cao G., Prior R.L. (1996). Total antioxidant capacity of fruits. *Journal of Agricultural and Food Chemistry*. 44: 701-705
- Yusuf A.A., Arowolo T.A., Bamgbose O. (2003). Cadmium, copper, and nickel levels in vegetables from industrial and residential areas of Lagos city, Nigeria. Food Chemical Toxicology. 41: 375-378.
- Zaidi M.I., Asrar A., Mansoor A., Farooqui M.A. (2005). The heavy metal concentrations along roadside trees of Quetta and its effects on public health. *Journal of Applied Science*. 5: 708-711.